AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A plane detection apparatus for detecting planes from three-dimensional distance data, the apparatus comprising:

a line fitting means for ~~fitting~~ forming at least a line [[to]] from each group of distance data points estimated to be in one plane in a three-dimensional space; and

a planar region growing means for extracting a plurality of lines estimated to be in one plane from a group of lines extracted by the line fitting means to calculate a plane from the plurality of lines,

the line fitting means ~~fitting~~ forming lines using a changeable threshold adapted to distribution of distance data points and noises included in the group of distance data points.

2. (Original) The apparatus according to claim 1, wherein the line fitting means extracts a group of distance data points estimated to be in one plane on the basis of the distance between the distance data points, and re-estimates, based on the distribution of the distance data points in the distance data point group, whether the distance data point group exists in one plane.

3. (Original) The apparatus according to claim 1, wherein the line fitting means extracts lines from a group of distance data points estimated to be in the one plane,

takes, as a point of interest, a distance data point whose distance to the lines is largest in the group of distance data points, judges, when the distance is smaller than a predetermined threshold, whether the distance data points in the distance data point group are unevenly distributed, and segments the distance data point group by the point of interest when the distribution is uneven.

4. (Original) The apparatus according to claim 1, wherein the line fitting means extracts a first line from the group of distance data points estimated to lie in the one plane, takes a distance data point in the group, whose distance from the first line is longest, as a point of interest, extracts a second line from the distance data point group when the distance is smaller than a predetermined threshold, judges whether a larger number of distance data points than a predetermined number exist continuously at one side of the second line, and divides the distance data point group by the point of interest when a larger number of distance data points than the predetermined number exist continuously.

5. (Original) The apparatus according to claim 4, wherein the line fitting means segments the distance data point group when the standard deviation of the distance data point group from which the first line has been determined is larger than a predetermined threshold.

6. (Previously Presented) The apparatus according to claim 1, wherein the planar region growing means selects more than one line estimated to be in one plane and

calculates a reference plane, searches lines estimated to be in the plane in which the

reference plane lies as grouping lines from the group of lines, updates the reference

plane with the grouping lines, repeats the grouping of the region of the reference plane,

and outputs the updated plane as an updated one.

7. (Original) The apparatus according to claim 6, further comprising a plane

recalculating means for recalculating a plane from the group of distance data points

except for ones whose distance from the updated plane is larger than a predetermined

threshold, if any, existing in the distance data point group in the updated plane.

8. (Previously Presented) The apparatus according to claim 1, wherein the planar

region growing means selects) The apparatus according to claim 6, wherein the planar

region growing means estimates, based on a difference between a lines-determined

plane and reference plane, whether the lines lie coplanar with the reference plane.

9. (Original) The apparatus according to claim 4, wherein the line fitting means

generates the second line by the least-squares method from a group of distance data

points estimated to be in the one plane.

10. (Original) The apparatus according to claim 1, wherein the line fitting means

extracts lines on the basis of three-dimensional distance data measured by a distance

measuring means which measures a distance on the basis of a parallax of two imaging

means.

11. (Original) The apparatus according to claim 1, wherein the line fitting means extracts lines on the basis of three-dimensional distance data measured by a laser range finder.

12. (Currently Amended) A plane detection method of detecting planes from three-dimensional distance data, the method performed by a processor comprising the steps of:

~~fitting~~ forming, by the processor, at least a line [[to]] from each group of distance data points estimated to be in one plane in a three-dimensional space, using a changeable threshold adapted to distribution of distance data points and noises included in the group of distance data points; and

extracting, by the processor, a plurality of lines estimated to be in one plane from a group of lines extracted by the line fitting means to calculate a plane from the plurality of lines to grow a planar region[[,]]

~~in the line fitting step, lines being fitted using a changeable threshold adapted to distribution of distance data points and noises included in the group of distance data points~~.

13. (Currently Amended) The method according to claim 12, wherein in the line ~~fitting~~ forming step, there is extracted a group of distance data points estimated to be in one plane on the basis of the distance between the distance data points, and it is re-

estimated, based on the distribution of the distance data points in the distance data

point group, whether the distance data point group exists in one plane.

14. (Currently Amended) The method according to claim 13, wherein in the line

~~fitting~~ forming step, there are extracted lines from a group of distance data points

estimated to be in the one plane, takes, as a point of interest, a distance data point

whose distance to the lines is largest in the group of distance data points, it is judged,

when the distance is smaller than a predetermined threshold, whether the distance data

points in the distance data point group are unevenly distributed, and the distance data

point group is segmented by the point of interest when the distribution is uneven.

15. (Currently Amended) The method according to claim 13, wherein in the line

~~fitting~~ forming step, there is extracted a first line from the group of distance data points

estimated to lie in the one plane, a distance data point in the group, whose distance

from the first line is longest, is taken as a point of interest, there is extracted a second

line from the distance data point group when the distance is smaller than a

predetermined threshold, it is judged whether a larger number of distance data points

than a predetermined number exist continuously at one side of the second line, and the

distance data point group is segmented by the point of interest when the larger number

of distance data points than the predetermined number exist continuously.

16. (Previously Presented) The method according to claim 12, wherein in the

planar region growing step, there are selected more than one line estimated to be in

one plane and a reference plane is calculated, there are searched lines estimated to be in the plane in which the reference plane lies as grouping lines from the group of lines, the reference plane with the grouping lines is updated and the grouping of the region of the reference plane is repeated, and the updated plane is outputted as an updated one.

17. (Previously Presented) The method according to claim 16, further comprising a plane recalculating step of recalculating, by the processor, a plane from the group of distance data points except for ones whose distance from the updated plane is larger than a predetermined threshold, if any, existing in the distance data point group in the updated plane.

18. (Previously Presented) The method according to claim 16, wherein in the planar region growing step, it is estimated, based on a difference between a lines-determined plane and reference plane, whether the lines lie coplanar with the reference plane.

19. (Currently Amended) An autonomous locomotion robot apparatus, comprising:

a distance measuring means for acquiring three-dimensional distance data;

a plane detection apparatus for detecting a plane from the three-dimensional distance data; and

a motion controlling means for controlling the motion of the apparatus on the basis of the result of plane detection by the plane detection apparatus,

the plane detection apparatus including:

a line fitting means for ~~fitting~~ forming at least a line [[to]] from each group

of distance data points estimated to be in one plane in a three-dimensional space; and

a planar region growing means for extracting a plurality of lines estimated

to be in one plane from a group of lines extracted by the line fitting means to calculate a

plane from the plurality of lines,

the line fitting means ~~fitting~~ forming lines using a changeable threshold

adapted to distribution of distance data points and noises included in the group of

distance data points.

20. (Original) The apparatus according to claim 19, further comprising a texture

imparting means for imparting a texture to an object.

21. (Original) The apparatus according to claim 20, wherein the texture imparting

means projects a texture to the object when acquiring the three-dimensional distance

data.